"Safety Management" Theory to Practice

Integrating a Human Factors Programme
Into Your Management of Safety

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14th ANNUAL HUMAN FACTORS
IN AVIATION MAINTENANCE SYMPOSIUM

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"Progress is impossible without change; and those who can not change their minds cannot change anything."
GEORGE BERNARD SHAW

INTEGRATING A HUMAN FACTORS PROGRAMME INTO YOUR MANAGEMENT OF SAFETY.

Contents:

♦ **Introduction**

♦ **Integrating a human factors programme**

     ➢ Positioning a human factors programme within an existing structure
     ➢ Activities of a human factors programme

♦ **Using interventions to manage safety, actual examples.**

  1. Out and about
     ➢ Face to face discussion session on human factors issues at the work-face
     ➢ Receiving sensitive information
     ➢ Advantages and risks

  2. Human solutions for human problems
     ➢ Shift hand-over
     ➢ Task hand-over
     ➢ Business process re-engineering
     ➢ Advantages and risks

  3. Standing on shaky ground
     ➢ Accident / Incident investigation error
     ➢ Industrial relations interface with human factors programme
     ➢ Advantages and risks

  4. Making good people better
     ➢ Human factors implementation strategy (Detail)
     ➢ Cultural shift strategy
     ➢ (Fig 1.) Characteristics of a maintenance engineer
     ➢ Training module
     ➢ Top Ten

♦ **Wash-up**

Introduction

Aircraft manufacturers and regulators together with Engineering and Maintenance (E&M) organisations form the foundations for inherent safety for the respective airlines in terms of the integrity of the airframe and its systems. The complexity of the matrix of inputs that are ever present is staggering. Opportunities to introduce errors into the system are many. Yet for the most part we as an industry and individual airlines manage to get "it" right.

E&M organisations world wide who have either introduced human factors programmes or are planning to do so are in reality saying, our business position needs are: to reduce our human error rate further if not eliminate it altogether. This business challenge is correct, noble and necessary in every sense. The problems however are vast and constantly either moving or changing at a rate that seemingly defies all of yesterday's business absolutes. Qantas is not immune from this business condition and is thoroughly committed to further improving our, and the industry's safety health. So where to start and where to position a human factors programme were the main questions confronting Qantas E&M, given that the Australian culture readily tolerates (perhaps more openly): frank view points than most.

Integrating a human factors programme.

The answer for Qantas in the main, was to first understand the problems that impacted upon our safety standards. Borrowing from available discussion papers indicated anecdotal evidence that Qantas did indeed exhibit similar error types of the nature experienced by other airlines. (The usual list of omissions and violations that we have all seen previously discussed at various human factors symposiums.) We realised that we were to embark upon a journey of discovery that others had made well before us and thankfully recorded their findings so well. Essentially our main effort in understanding human factors issues was and remains to this day, in reading specific papers and books on the subject and comparing that information with our own observations, through our new found perspective. The next issue was to decide where to place the programme within the organisation.

Qantas reached a relatively simple conclusion. Briefly, if negative outcomes present themselves at the end of a chain of events that: culminate in the form of unsafe production activities being combined with inadequate defences, then we should concentrate our effort in bolstering up our defences. Because in all likelihood the same people conducting the unsafe acts are the very same people responsible for those same final defences. Best that we place our human factors programme in the area that needs to better recognise those threats and accept ownership of the solutions that will surely be needed.

The conclusion reached on how to implement and position a human factors programme however was to take Qantas on a path that to our knowledge, had not been previously undertaken or fully understood. Clearly this was a risk. Every paper read: spoke of the negative outcome resultant from failed programmes and the difficulties associated with starting a new.

This conclusion needs to be understood in terms of the relationship of the Human Factors programme and the comprehensive quality and safety system that already existed. This programme was to enhance and refine the "system" further. The approach agreed upon was to select 7 front line maintenance engineers that were to form the working group. The 7 would represent each of the main maintenance areas within the network. The group is known by the acronym HEAR. (Human Error & Accident Reduction) The name was suggested and adopted by the front line maintenance engineers themselves. HEAR functions on a part-time and independent basis to identify negative issues, assists in developing solutions and initiating corrective actions. All initiatives and suggestions are communicated through the existing E&M structure. Should difficulties arise, HEAR has direct access to a "Patron" in the form of a nominated General Manager. This patron can then open doors to the group and fast track solutions. In practice it is all quite low key in profile.

The key strength of this approach is that any solution (read change) if it is to work; must be first accepted by the maintenance engineers as being workable. (Read of some use to them) As the solution was suggested from within their own ranks, higher rates of acceptance are anticipated and ownership of both the problem and the solution amongst the maintenance engineers should at least allow for a smoother implementation period. Maintenance engineers would be given a chance to manage change and alter the conditions under which they work. Threats and negative aspects will be discussed later in the examples of actual interventions.

Whilst this is a much abbreviated description of the approach taken by Qantas it none the less helps to illustrate the grass roots level activities and the high level access and support afforded to the HEAR group. Some will have picked up on the fact that a part of this approach requires the HEAR group to work without "nets", fundamentally opposite to anything taught in the text books. Well, we quickly learnt to hold onto our credibility very tightly indeed.

USING INTERVENTIONS TO MANAGE SAFETY

1. Out and about

Interventions in the context of an established and formal reporting hierarchy can and very often mean, "interfering". After all the ultimate responsibility for the issue rests quite correctly with the appropriate manager. So how then to approach an issue that seemingly exists with the appropriate manager's knowledge and perhaps with his "unofficial" approval? Or a localised group are developing and using "norms" that include short cuts as the first option. Just two of the hypothetical situations that may exist when the HEAR group visit various bases.

The HEAR team conducts tours of Line Stations to disseminate human factors information and receive feed-back from the front line troops that might otherwise not be tabled. As part of any tour, when the HEAR representatives arrive (usually two) they contact the local manager first and discuss the basic thread of the likely discussions. The local manager will have been notified well in advance via his General Manager of the visit. This meeting is very much an informal chat and a chance for both parties to get to know each other.

However there is now a certain and inevitable tension that exists between the parties, even if not apparent, that the HEAR team will receive either "in-house" information or perhaps much worse, information not known to the manager. As part of the initial discussions a commitment is volunteered from the HEAR representatives: that information that is received will be handled with careful consideration and respect for both his and the engineers needs, but that safety considerations will determine any follow-up actions.

The discussions take the form of a lunchroom chat during quiet operational periods. As an example this can be 02:00 if necessary. For the most part the feedback is easy to deal with and can take the form of ongoing issues with support departments that are the cause of some form of frustration. These maintenance engineers can often be working in "organisational isolation." The HEAR team member can offer a solution immediately or upon his return to the main base will track down the offending department and initiate formal action items or simply give low key feed-back. This helps both the local manager as well as the maintenance engineer.

However on some very rare occasions information is received that is "sticky" to say the least. On these occasions the maturity of the HEAR representative is vital and to date proved to be sound. The solution might be to talk to the group generally on a subject that has a direct message to the individual/s within. The message will contain a content of moral outrage (from the peer group perspective) that is associated with these actions. They (the maintenance engineers) will then get the gist of the message and suspect that the actions in question are definitely known to managers. Where the situation is important enough to suggest a more formal response then the manager is informed directly, but the context of the situation is clearly put which is to ensure that reporting of issues are not diminished as a result. That would serve little purpose.

Following such a tour the patron will be informed of emerging trends or issues that need to be understood and perhaps addressed further. The second such tour is now under way. It is now also using the standardised common questions in the form of a voluntary questionnaire so that certain trends can be monitored over time.

Issue: Maintenance engineers briefing other maintenance engineers.

ADVANTAGE	RISK
➢ Information obtained in this forum is of a local context, corporate wide solutions are not necessary.	➢ The information supplied may be a "red herring" and simply meant to stir up the manager.
➢ The local group can see a demonstrated improvement or know that they have been heard.	➢ The HEAR group gives a commitment that can't be delivered.
➢ Sticky situations are dealt with sensitivity and without public broadcast.	➢ Personalities injured and issue goes underground. ➢ HEAR group credibility damaged.
➢ Creates a sense of immediate understanding as to the thoughts of maintenance engineers.	➢ Delays in returning to the bases can be interpreted in negative ways.
➢ Head off ingrained problems	➢ Incorrect solution chosen.
➢ Cultural shift to not accepting anything less than safety and quality on all occasions through moral outrage driven through peer group.	➢ Pedantic behaviour being misunderstood as being moral outrage. ➢ HEAR group not recognised as a peer group.

2. Human solutions for human problems

Task hand-over is a significant opportunity for human error to be introduced. Maintenance organisations for decades have known about the difficulties associated with hand-over. And with every initiative comes yet another example of how people can get it wrong, in some cases with tragic consequences. For the most part errors are recognised in time and measured in terms of missed production milestones and delayed departures. But what of the human element?

To date the main effort with regard to hand-over has been in Heavy Maintenance areas. The HEAR group set out to understand the basic mechanisms at play and identify the opportunities for improvements. People from both Melbourne and Sydney Heavy Maintenance sections were involved with the project. Their ideas and shop floor savvy combined to determine a workable solution. In this case a fixed format pro forma document that clearly laid out the essential information agenda that needed to be addressed at the end of each shift. Subtle design features were incorporated in some cases that actually limited the amount of information that could be entered so that critical priorities were kept simple and transparent. Amplifications on details could be placed in the notes area and detailed outstanding maintenance manual requirements were to be found on the actual task cards where certification was to take place.

To help over come the glacier pace of change evident with previous shop floor suggestions, the production of the pro forma booklets was fast tracked. In fact the use of photocopied versions were in use prior to final delivery. The HEAR representative was the "champion" for the cause and ensured that any negative comments were quickly addressed.

The pro forma is now universally used in both areas and with good results. The next steps are to introduce MRM techniques into crew hand-over and roll out similar projects in the Line Maintenance areas.

On a second front but to date limited to the domestic arm of Qantas, "routine" task cards were critically reviewed and completely modified. By coincidence for the HEAR group a business process re-engineering (BPR) exercise was undertaken that was to give plenty of opportunities to fix some systemic issues and it was to be coordinated by this author.

From the perspective of hand-over, every MPD task in the mechanical trades categories was completely modified to: remove duplication, work area ambiguities, wording ambiguities, define exact approved data requirements and segmented in such a way as to allow each process stage to be completed within a single shift duration. This was accomplished through a comprehensive consolidation of all task requirements that involved both the manufacturer and the regulator. Hand-over needs mid inspections and routine MPD tasks were all but eliminated. Non routine tasks were simplified further with the redesign of the non routine task card, which was to include a one snag per card concept and the incorporation of some reporting needs into the very same pro forma. Further, all tasks were arranged in a system that clearly grouped / bunched tasks that had either common processes or geographic locations. No task was hidden or could lay dormant in the same way as before.

Compliance, the fundamental foundation base of any safety and quality system is now a more robust defence and very difficult to penetrate. Design and content were driven from the maintenance engineer's needs up, with the main conduit of additional reporting obligations a feature that was derived from the one task card not by a separate process that distracts the person certifying. Ramifications of change went all the way back to the manufacturer and MPD errors were removed and improvements incorporated into the MPD for all to share.

Issue: Hand-over initiatives driven by the "floor" and refined task cards

ADVANTAGE	RISK
➢ Standardisation of a hand-over pro forma ensures consistency & predicability.	➢ Can be done the wrong way every time.
➢ Tiered hand-over structure ensures that high priorities do not get hidden in the technical details.	➢ If practices are not "policed" on a regular basis, poor practices can be introduced relatively easily.
➢ Highly refined tasks allow for more consistent work-scope without maintenance misinterpretation.	➢ "Bush lawyers" can "read in" information that simply doesn't exist. ➢ Flexibility in approach can be diminished. ➢ Simple ad hoc task inclusions demand the extra (and perhaps superfluous) detail to be included.

3. Standing on shaky ground

The moment that an organisation decides to adopt a human factors programme the issue of disciplinary policy will soon be tabled. If it isn't, then the organisation either has in place a fair and just disciplinary system accepted by most or quite simply the importance of the issue has been misjudged. The process of human error reduction requires thorough investigations and consequently, findings may show that to some degree a person or persons have breached accepted service standards. MEDA relies on open disclosure of information to the investigator.

It was not long after the first Line Base tour was concluded that a significant maintenance error occurred. A young employee missed injury. Others in the area were also spared injury through good fortune, however the aircraft suffered significant damage.

The manager responsible for the area carried out the main investigation. His initial findings were based on the conversations of those interviewed and as is the formal practice those people that were seemingly responsible for the outcome were stood down without prejudice. This is a very important aspect of the agreement in place, as the people directly involved may be in such an emotional state that for their own good, requires them to be relieved from duty. (Even though the full emotional state of an individual/s may not be apparent.)

The investigation however was less than accurate in many ways and the subsequent disciplinary actions tabled were directed towards an innocent person in the view of the local maintenance engineers. The words from the recent HEAR group briefing regarding "Thorough incident investigations" and "No blame" were freshly remembered by all.

The trade union immediately invoked their legal right for appeal. A HEAR group member who just happened to be on the same crew and also a trade union representative quickly went into (what he deemed to be) damage control mode. Another HEAR group member did exactly the same except not through the industrial channel. The later had full and frank discussions with a senior manager regarding the situation, a difficult and testing set of circumstances developed as a result. Not unexpectedly, considering the seriousness of the subject matter, the uninvited intervention and the "organisational gradient" between the two positions. But necessary in the mind of the HEAR representative to protect the human factors programme's future.

The senior manager's main points being,
- The manager initially thought that the HEAR group were trying to protect one of their own
- A formal investigation had been carried out and that a clear culprit had been identified
- Due processes were clear and carried out successfully
- HEAR had no role in this type of matter

The HEAR group representative's main points being,
- The investigation was flawed
- The "culprit" identified was simply doing what he was asked to do by other person/s
- That this action from the HEAR group representative was necessary to protect the individual and the credibility of HEAR members
- The human factors programme's future was indeed in the balance

Eventually the appeal process exonerated the maintenance engineer first accused and also found the investigation to have been significantly flawed. Innocent personalities were damaged and "HEAR" survived the earth tremors that had threatened to crack its very foundations.

A comprehensive human factors programme is completely dependent on high level support. This situation was no exception. Indeed had it not been for this factor and the fact that the senior manager was willing to, at least listen, to the points of view put forward and equally to investigate those same points, this human factors programme would have ceased to exist.

Disciplinary policy and procedure is necessary and well understood and is usually formalised in terms of corporate policies and procedures as well as in the terms and conditions under which the employee's legal rights are enshrined. In terms of accident/incident investigations and disciplinary process, consistency in approach and outcome is very often the measure by which the system in use is judged by the employees. However human error is just as likely in the investigation and disciplinary processes and when this occurs in conjunction with industrial sensitivities, previous messages of "No blame" or "Just" culture are quickly lampooned. Employee disgust at such an outcome will demand a retraction and question the worth of a human factors programme. "Forget open disclosure" will be the common point of conversations. In some cases trade associations and unions may reconsider their support to the human factors programme, for the time being forgetting that the blame culture that so much disgusts [them] is the very same retort offered by themselves as being a just response.

MEDA at this stage had not yet been introduced, and it is worth pondering as to what would have eventuated had it been available. Is attribution bias on the part of the investigator removed from the process by such a pro forma when emotions can be running high?

Subsequently to this transitional period, MEDA was introduced and has been in use for 2 years.

Issue: Human factors programme interventions into the human/industrial relations arena

ADVANTAGE	RISK
➢ Cultural shift towards open disclosure of information after an incident	➢ Attribution bias on the part of the investigator…incorrect conclusions ➢ Trade union coaching members being investigated to emphasise secondary contributing factors as being primary
➢ Coaching investigator/s as to legitimate "real world" work practices and need for same	➢ Information misused ➢ New and unworkable procedures introduced without necessity ➢ Reduced worker flexibility
➢ Protect human factors programme	➢ Offend management ➢ Reason for intervention incorrect
➢ "Just" culture engendered	➢ Trade union misinterpretation of "just" culture as being zero retribution culture ➢ HEAR seen as apologists for management
➢ Ownership of problems and solutions at the grass roots level	➢ Rejection of ownership at the grass roots level

4. Making good people better

Training people to better understand human factors is a difficult issue: the concepts espoused in terms of human behaviour, ergonomics and the like do not necessarily interest everyone in the same way as a technical course that has clearly defined parameters and processes that must be met. The subject of human factors is similar in many ways to medical information regarding diets and exercise, quite apart from the fact that no single such solution suits every person. People may defer interest in the subject because their health is okay at present. Perhaps these same people don't even recognise the symptoms present as threatening their own health.

James Reason introduced us all to the concept of organisational safety health and this has now altered our general perspective' on safety as a result. This concept together with the HEAR group's view that our maintenance engineers per se are safety orientated first and foremost: that we focus training towards challenging individuals towards reassessing their own behavioural traits. In this way we are not naively asking people to behave better and act responsibly. Remembering that for the most part, our people already conduct themselves "professionally", but rather HEAR relies on the common characteristic of maintenance engineers to "nut out" for themselves the solution/s for further improving their own personal safety health, underpinned by their task certification responsibilities and obligations.

Affectively, our approach is derived from resource level issues: because our group members are also key staff in terms of production needs we need to ensure that our absences are well timed and effective. Timing is never perfect but as a minimum we ensure that the local manager is satisfied. Effectiveness then is a combination of our strategy being sound together with our ability to communicate the messages in the correct context.

In a nutshell, our objective is to initiate a voluntary cultural shift within the E&M organisation to further improve our safety and quality ethic. The strategy to accomplish this objective is structured through five directions.

(i)   **Base tour face to face sessions** to cover topics of current and emerging human factor issues and invite inputs. The focus of the meetings will be to enforce further a general view of mutual "moral outrage" at complacency and the lack of thoroughness on the part of some maintenance engineers. This we hope will:
- Bolster peer group pressure on safety issues
- Alert maintenance engineers of their fallibility to error
- Introduce new and reinforce current safety concepts
- Allow some the difficult issues to be put to HEAR and allow those same issues to be pursued through higher levels by HEAR

(ii)   **Questionnaires.** HEAR will send out a questionnaire to the base to be visited prior to our arrival. It is envisaged that this will:
- Generate shop floor conversations of a safety nature,
- Accumulate a HEAR data base of shop floor attitudes and trends,
- Provide everyone a chance to give an opinion even though they might not be on shift at the time of our visit
- Provide the ability to ask questions of all respondents in the same manner and context.

(iii) **Formal training** by way of induction sessions for new trainees/apprentices and re-currency training for maintenance engineers, delivered by HEAR representatives. In each case the theme of "moral outrage" is reinforced.
- Trainees are captured early
- Maintenance engineers will receive a human factors module as part of re-currency courses that are to be ongoing. (Actual module content discussed later)
- Technical instructors are informed by HEAR representatives of messages and styles of class room instruction delivery that are considered best to improve human factors understandings

(iv)   **Normal and routine business processes** that form the safety and quality system attend to all issues impacting on compliance and production. These processes are laid out in Qantas procedures manuals. Related human factors requirements are:
- MEDA
- Safety and quality audits and forums at various management reporting levels
- Quality alert bulletins
- Safety department organisational structure with direct reporting to the CEO

(v)   **Close relationship with the Australian Transport Safety Bureau (ATSB).** Formally (BASI) This aspect forges a partnership with the ATSB to better understand maintenance safety issues for both parties and helps develop human factors understandings. Mainly through:
- Regular invitations for a ATSB investigator to sit in on HEAR meetings
- Sharing understandings
- Nurturing a common goal

The combination of these five inputs should help shift Qantas E&M safety culture towards the objective. This strategy is deliberately evolutionary and methodical because of the very nature of cultural shift and the ability of people to both deal with and accept change. Changes introduced will impact at "normal" pace and through established channels.

Acceptance of changes will be through critical mass of opinion, if you like, through demonstrated benefits not concepts.

The human factors training module mentioned earlier is structured at this point in time to only be an introduction to the subject. Consequently the time allocated for the session is only three hours. The content is in four sections:

(i)   Background/history,
(ii)   Establishing a need for better understandings of human factors,
(iii)   "Reason" model of accident causation,
(iv)   Helpful tips on how to approach the job with a view to reducing human error through improving personal traits.

The latter, is based on the "Dirty Dozen" training notes from United Airlines® but modified significantly to suit HEAR objectives. The result is the "Top Ten". The reason for this wasn't through idealism for the metric system! But rather in response to a matrix of characteristics derived from Richardson Management Associates, that HEAR believes to be representative of Qantas maintenance engineers. HEAR then apportioned good and bad points against each characteristic. This then helped guide our main focus of attention.

(**Fig 1.**)   **CHARACTERISTICS OF A MAINTENANCE ENGINEER**

Characteristic *Richardson Management Associates	Good point (HEAR)	Bad point (HEAR)
Dependability*	Highly motivated Good attendance	If taught the wrong way or norms dictate, can be depended to do it the wrong way every time
Willingness to put in effort*	Likes to stay with the job until it is finished	- Can fatigue themselves - Can stress themselves - Can cut corners
Integrity*	Works to the best of their ability	
Modesty*	Easy to work with	Will not speak out
Distrust of words*	Questioning of bad procedures	Will not always follow written procedures
Loner*	High degree of initiative Will get the job done	Will not always: - ask for assistance - follow procedures
Doesn't like to ask for help*	Less manpower required Minimal supervision	- Can do the job incorrectly - Can stress themselves - Can take too long on task
Self sufficient*	Resourceful	Doesn't always use the correct equipment
Thinks things out by themselves*	Inquisitive & questioning of procedures Suggests better methods	Can short cut tasks without thought of future repercussions
Doesn't share thoughts*	Not likely to offend others	Self imposed: - Stress - Pressure - Distraction

These characteristics were then juxtaposed with the "Dirty Dozen" with an intended bias towards "Green light thinking" which resulted in the "Top Ten". They are:

1. **Assertiveness**
2. **Due Care**
3. **Lifestyle Management**
4. **Pressure Control**
5. **Recognising Your Resources**
6. **Knowledge**
7. **Understanding "Norms"**
8. **Effective Communication**
9. **Teamwork**
10. **Vigilance**

Each Top Ten trait concentrates on staying positive and further give tips on how to develop personal skills for each. A point is made that these traits are not exclusive of each other and that all must be present at all times to work within a team environment and to help reduce human error. Again stressing that "for the most part we are very good at what we do, its just that there is always room for improvement." In the future we hope to workshop each trait to develop the skills further.

This is a relatively low risk strategy for HEAR, the only risks coming from:

(i)   Time constraints,
(ii)   HEAR not returning to bases periodically,
(iii)   Re-currency training schedules being spread over an extended period of time
(iv)   And of course home section business commitments. (Our real jobs)

5. Wash-up

Both the approach adopted by Qantas in the formation of the HEAR group and the HEAR group has challenged the more traditional approaches in the introduction and management of Human Factors issues. Where frontline staff together with management is actively facilitating Human Factors orientated safety improvements. Headline successes are few but those successes achieved are real and sound to date. The key to success factors remain as they were from day one of the programme: High level commitment and confidence in the HEAR team and its ideals by all levels of the organisation.

A strategy for a voluntary: safety cultural shift, through what is a process of acquiescence is a long-term project that requires firm managerial and HEAR group patience. Much in the same manner that foreign foods and cuisines enter our diet gradually over an extended period of time. As we learn more of the new cultures and habits we move from tolerance towards acceptance. Imagine if authorities had insisted on the consumption of these new cuisines, we can only guess as to what would have been the likely outcome. But we do know that ultimately people will choose what suits them best. Look no further than the expansion in the use of the Internet: some embrace the technology others don't.

HEAR is entering its sixth year of being during this symposium and yet, little is known or understood of the programme by many within Qantas. This is not a real problem, in fact it is a strength in many ways as human factors problems are not readily delegated to a human factors department, but rather are dealt with by those that own the problem. HEAR is there to assist, not direct. All of which ultimately helps develop crucial safety defences further by those people directly responsible for them. Understanding each defence in detail means that we better recognise the resultant threat, by those likely to breach them. In a number of ways, our jobs within this industry are to continuously develop, strengthen and protect our defences.

However in my opinion, some of the defences are being undermined, little by little, through innocent and well meaning inputs over which we have little control. The regulator and quality assurance operatives through audits and general activities can often take a very black and white view on matters, often with an example sample of one. Occasionally, relatively insignificant issues are given such emphasis that would let people believe that the regulator views the subject as being paramount. Occasionally significant changes are introduced without full consultation. Political arguments to one side: the net result is a noticeable shift towards a more "legal culture" that is both inflexible and orientated to determining why you

can't do it rather than how you can do it. This manifests itself by way of relatively minor changes to procedures that render them complex and inflexible when ideally maintenance engineers require a degree of useful latitude. In effect, to ensure those procedures are followed. These occasional negative actions by regulators and quality assurance operatives are difficult to understand given that the major RPT carriers are not inherently unsafe by any parallel. This author can not help but consider the possibility that if in the future, changes occur that may put a relatively minor legal position ahead of safety considerations in the minds of some. The mind boggles at such an outcome. Clearly this situation should it ever exist, it would be counterproductive to safety efforts and be in direct competition with a human factors programme that relies in no small part on open disclosure of information at all levels. Human Factors programmes need to be maintenance engineer focused because it is they that must deliver the final product and also have the support to do so.

Whenever Human Factors discussions take place, it is worth remembering the famous quote by G B Shaw: *"Progress is impossible without change; and those who can not change their minds cannot change anything."*

<div align="center">**END**</div>